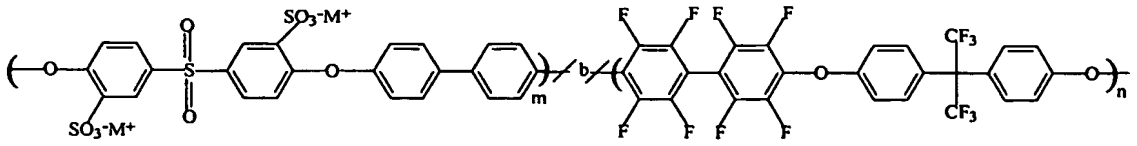
CLAIMS

We claim:

1. A multiblock copolymer with chemical structure



where M+ is a positively charged counterion selected from the group consisting of potassium, sodium and alkyl amine, m = 2 to 50, n = 2 to 30, and b represents connection of respective blocks.

2. The multiblock copolymer of claim 1, wherein m + n is at least 4.

3. The multiblock copolymer of claim 1, wherein m + n is from 4 to 80.

4. A proton exchange membrane (PEM) comprising a multiblock copolymer that comprises at least one hydrophobic segment and at least one hydrophilic segment, wherein the membrane has co-continuous morphology of hydrophobic and hydrophilic segments, has a mean humidity in a range of from 10% to 80%, and has proton conductivity in a range of from 0.005 to 0.3 S/cm.

5. The PEM of claim 4, wherein the mean humidity is in a range of 25% to 70%.

6. The PEM of claim 4, wherein the proton conductivity is in a range of 0.05 to 0.25 S/cm.

7. The PEM of claim 4, wherein the mean humidity is in a range of 25% to 70% and the proton conductivity is in a range of 0.05 to 0.25 S/cm.

8. The PEM of claim 4, wherein the hydrophobic segment is perfluorinated.

9. The PEM of claim 4, wherein the hydrophilic segment is disulfonated.

10. A method of making a multiblock copolymer comprising a fluorinated hydrophobic segment and a sulfonated hydrophilic segment, comprising the step of:
reacting at least one fluorinated block with at least one sulfonated block in a condensation reaction to form a multiblock copolymer.

11. The method of claim 10, wherein the fluorinated block itself was made by a condensation reaction.

12. The method of claim 10, wherein the sulfonated block itself was made by a condensation reaction.

13. The method of claim 10, wherein the fluorinated block and the sulfonated block themselves were made by condensation reactions.

14. The method of claim 10, wherein at least two fluorinated blocks and at least two sulfonated blocks are reacted in the condensation reaction.

15. The method of claim 10, wherein a number of fluorinated blocks being reacted in the condensation reaction is in a range of 2 to 30 and a number of sulfonated blocks being reacted in the condensation reaction is in a range of 2 to 50.

16. The method of claim 10, wherein a sufficient number of blocks are used in the condensation reaction to form a polymer electrolyte membrane.

17. The method of claim 10, wherein the fluorinated block is a perfluorinated block.

18. The method of claim 10, wherein the sulfonated block is disulfonated.

19. The method of claim 13, wherein the multiblock copolymer of claim 1 is formed by the condensation reaction.

20. The method of claim 10, wherein a multiblock copolymer comprising at least two perfluorinated poly(arylene ether) segments and at least two disulfonated poly(arylene ether sulfone) segments is formed.

21. The method of claim 10, wherein by a step growth procedure, a proton exchange membrane is constructed.

22. An ion-exchange resin comprising a multiblock copolymer comprising at least one fluorinated hydrophobic segment and at least one sulfonated hydrophilic segment, wherein the multiblock copolymer has been formed by a condensation reaction.

23. The ion-exchange resin of claim 22, wherein the sulfonated hydrophilic segment is disulfonated.

24. The ion-exchange resin of claim 22, wherein the fluorinated hydrophobic segment is a perfluorinated ether.

25. The ion-exchange resin of claim 22 including perfluorinated poly(arylene ether) and disulfonated poly(arylene ether sulfone) segments.

26. A fuel cell comprising:

a polymer electrolyte membrane (PEM) comprising a multiblock copolymer comprising: at least one fluorinated hydrophobic segment and at least one sulfonated hydrophilic segment, wherein the multiblock copolymer has been formed by a condensation

reaction;

an anode and a cathode.

27. The fuel cell of claim 26, wherein the sulfonated hydrophilic segment is disulfonated.

28. The fuel cell of claim 26, wherein the fluorinated hydrophobic segment is a perfluorinated ether.

29. The fuel cell of claim 26, wherein the PEM includes perfluorinated poly(arylene ether) and disulfonated poly(arylene ether sulfone) segments.